Bina Aspen
800 K Street, South
Suite 750
Washington, D.C. 20001

David E. Leibowitz
Recording Industry Association of America
1020 19th Street, N.W.
Washington, D.C. 20036

Kenneth E. Satten and Christine V. Simpson
Wilkinson, Barber, Knauer & Quinn
1735 New York Avenue, N.W.
Washington, D.C. 20006

William P. Suffa, P.E.
6402 Ronson Court
Alexandria, VA 22310

Ben C. Fisher, David D. Oxenford and
Martin R. Leader
Fisher, Wayland, Cooper & Leader
1255 23rd Street, N.W., Suite 800
Washington, D.C. 20037

Quincy Rodgers
General Instrument Corporation
1155 21st Street, N.W., 4th Floor
Washington, D.C. 20036

Steve Kuh
Dr. James Wang
LinCom Corporation
5110 W. Goldleaf Circle, Suite 330
Los Angeles, CA 90056

Howard F. Jaeckel
John W. Zucker
51 West 52 Street
New York, NY 10019

Leonard S. Kolsky
Motorola Inc.
1350 I Street, N.W.
Suite 400
Washington, D.C. 20005

Reuben Veliz
VTech (OEM), Inc.
910 Bern Court
Suite 150
San Jose, CA 95112-1237

David Gordon
NCOA 11307 Sunset Hills Road
Suite B-7
Reston, VA 22090

David E. Poisson
Consumer Electronics Group
Electronic Industries Association
2001 Pennsylvania Ave., N.W.
Washington, D.C. 20006

Werner K. Hartenberger
Kevin F. Reed
Suzanne M. Perry
Dow, Lohnes & Albertson
1255 23rd Street, N.W., Suite 500
Washington, D.C. 20006

Paul E. Symczak
Pamela Joy Brown
Corporation for Public Broadcasting
901 E Street, N.W., Suite 200
Washington, D.C. 20004-2006

Michael H. Bader
William J. Potts, Jr.
Wallace E. Johnson
Haley, Bader & Potts
2000 M Street, N.W., Suite 600
Washington, D.C. 20036

Dew Eginton
Pacific Communication Sciences, Inc.
10075 Barnes Canyon Road
San Diego, CA 92121

Erwin G. Krasnow
Jacqueline R. Kinney
Verner, Liipfert, Bernhard, McPherson
and Hand
901 15th Street, N.W., Suite 700
Washington, D.C. 20005

Jack W. Mitchell
Wisconsin Public Radio
821 University Avenue
Madison, Wisconsin 63706

Thomas B. Patton
North American Philips Corporation
Suite 1070 East 1300 I Street, N.W.
Washington, D.C. 20005

Frederick L. Spaulding, P.C.
883 San Simeon Drive
Mountain View, CA 94043

John M. Pelkey, Craig J. Blakeley
Margaret L. Tobey, Adam M. Eisgrau
Sidley & Austin
1722 Eye Street, N.W.
Washington, D.C. 20006

Jeffrey Sheldon
Mara J. Pastor
Utilities Telecommunications Council
1620 Eye Street, N.W., Suite 515
Washington, D.C. 20006

Stephen A. Hildebrandt
Westinghouse Broadcasting Co., Inc.
1025 Connecticut Avenue, N.W., Suite 506
Washington, D.C. 20036

Lawrence Roberts
Mark N. Lipp
Mullin, Rhyne, Emmons and Topel, P.C.
1000 Connecticut Avenue, N.W., Suite 500
Washington, D.C. 20036

William E. Hurt
KCSU-FM
Colorado State University
Fort Collins, CO 8523

John E. Fiorini III
Mark Van Bergh
Gardner, Carton & Douglas
1001 Pennsylvania Ave., N.W., Suite 750N
Washington, D.C. 20004

William P. Welty
Continental Satellite Corporation
5607 Malden Court
Bakersfield, CA 93306

Gary K. Noreen
Radio Satellite Corporation
One World Trade Center, 8th Floor
Long Beach, CA 90831

Robert A. Maker
Albert Shuldiner
Nixon, Hargrave, Devans & Doyle
One Thomas Circle, N.W., Suite 800
Washington, D.C. 20005

Andrew D. Lipman
Ann P. Morton
Swidler & Berlin
3000 K Street, N.W., Suite 300
Washington, D.C. 20007

Philip Schneider
Geostar Messaging Corporation
1001 22nd Street, N.W., Suite 550
Washington, D.C. 20037

Henry C. Rock, II
The Right-Roc Group
331 West 57th Street, Suite 157
New York, NY 10019

Louis Schwartz
Malcolm G. Stevenson
Schwartz, Woods & Miller
1350 Connecticut Avenue, N.W., #300
Washington, D.C. 20036

E. W. Bundy, Ph.D
1603 Sigma Chi Road, N.E.
Albuquerque, NM 87106

Gary J. Shapiro
Home Recording Rights Coalition
c/o Electronic Industries Association
Consumer Electronic Group
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006

Ernest T. Sanchez
Gerald Stevens-Kittner
Arter & Haden
1919 Pennsylvania Avenue, N.W.
Suite 400
Washington, D.C. 20006

Steve A. Lerman
Sally A. Buckman
Levanthal, Senter & Lerman
2000 K Street, N.W., Suite 600
Washington, D.C. 20006-1809

Steven Horvitz
Hogan & Hartson
Columbia Square
555 Thirteenth Street, N.W.
Washington, D.C. 20004-1109

General Manager
WHOT, Inc.
4040 Simon Road
Younstown, OH 44512

Ms. Lynn Chadwick
National Federation of Community
Broadcasters
666 11th Street, N.W., Suite 805
Washington, D.C. 20001

Donald R. Gladwell
Mayor
City Hall
P.O. Box 790
Montrose, CO 81402

Myron Jones, CEO
The Jet Broadcasting Co., Inc.
8455 Peach Street
Erie, PA 16509

Jeffrey Eustis
862 Lathrop Drive
Stanford, CA 94305

Thomas R. Duffy
Mercury Digital Communications, Inc.
243 El Dorado Avenue
Monterey, CA 95126

Gary K. Noreen
Chairman & CEO
Radio Satellite Corporation
1167 North Holliston Avenue
Pasadena, CA 91109

Francis Nash
General Manager
Carter County Broadcasting Co., Inc.
P.O. Box 487
U.S. 60 West
Grayson, KY 41143--0487

Philip L. Verveer, Esq., Sue D. Blumenfeld, Esq.
Willkie, Farr & Gallagher
Three Lafayette Centre
1155 21st Street, N.W. Suite 600
Washington, D.C. 20036-3384
Counsel for Loral Aerospace Holdings, Inc.

Timothy J. Calcara
General Manager
KTOF-FM Radio
1957 Blairs Ferry Road, N.E.
Cedar Rapids, IA 52402

Robert A. Mazer, Esq.
Nixon, Hargrave, Devans & Doyle
One Thomas Circle, N.W., Suite 800
Washington, D.C.
Counsel for USA Digital Radio Partners, L.P.

Greg Thomas
General Manager
K--Lite Radio
P.O. Box 3834
San Angelo, TX 76902

Donald C. Alexander
Station WTNY
134 Mullin Street
Watertown, NY 13601

John S. Neely, Esq.
Miller & Miller, P.C.
P.O. Box 33003
Washington, D.C. 20033
Counsel to Crawford Broadcasting Company

L. Jack Hill, President
Station KGNZ (FM)
1001 Cedar Crest
Abilene, TX 79601

Tim McDermott
General Manager
KSBJ
P.O. Box 387
Humble, TX 77347

Hiram H. Champlin
President
Chisholm Trail Broadcasting
316 E. Willow
P.O. Box 952
Enid, OK 73702

Ira L. Greenstein
Senior Vice President
Digital Evolutions Ltd.
4660 Kenmore Avenue
Suite 1018
Alexandria, VA 22304

Mike Bradley
Station Manager
WHOB
55 Lake Street
Nashua, NH 03060

Joseph D. Jones
Organization
10680 W. Pico Blvd
Suite 444
Los Angeles, CA 90064

Bill Walters
WASE (FM)
P.O. Box 2087
Elizabethtown, KY 42702-2087

John R. Peters
Vice President
Talley Broadcasting Company
P. O. Box 369
Highway 61 North
Fort Madison, IA 52627

Robert G. Thomas
Vice President/General Manager
WJAG & KEXL
P.O. Box 789
Norfolk, NE 68702-0789

Arnie McClatchey
McClatchey Broadcasting Co.
KELP Radio
6900 Commerce
El Paso, TX 79915

Randy Rich, President
Christian Broadcasting Academy
3107 Eubank, NE #2
Albuquerque, NM 87111

M. G. Abutaleb
President
Innovative Communications Technologies, Inc.
362-C Christopher Avenue
Gaithersburg, MD 20879

John E. Fiorini, III, Esq.
Gardner, Carton & Douglas
1301 K Street, N.W.
Suite 900, East Tower
Washington, D.C. 20005
Counsel to Radio Operators Caucus

Lonna M. Thompson, Esq.
Fletcher, Heald & Hildreth
1300 North 17th Street
11th Floor
Rosslyn, VA 22209
Counsel to Cornell University

Steven A. Lerman, Esq.
Sally A. Buckman, Esq.
David S. Keir, Esq.
Leventhal, Senter & Lerman
2000 K Street, N.W., Suite 600
Washington, D.C. 20006

James L. Casserly, Esq.
Squire, Sanders & Dempsey
1201 Pennsylvania Ave., N.W.
P.O. Box 407
Washington, D.C. 20044
Counsel to Consumer Electronics Group of
the Electronic Industry Association

David M. Hunsaker
Putbrese & Hunsaker
6800 Fleetwood Road, Suite 100
P.O. Box 539
McLean, VA 22101-0539

Peter H. Feinberg, Esq.
Laura H. Phillips, Esq.
Down, Lohnes & Albertson
1200 New Hampshire Avenue, N.W., Ste. 800
Washington, D.C. 20036
Counsel for Jones International, Ltd.

Lois A. Williams, Vice President
General Motors Corporation
c/o Room 322 - Research Engineering Building
P.O. Box 9055
30500 Mound Road
Warren, MI 48090-9055

Neil R. Helm
Program Director
The George Washington University
School of Engineering and Applied Science
801 22nd Street, N.W.
Washington, D.C. 20052

Michael Laflin, Director
EDC, LearnTech Project
1250 24th Street, Suite 300
Washington, D.C. 20037

Donald Biddinger
Michigan State Director
The Good Sam Club
1560 N. Eifert Lot 11
Holt, MI 48842

Brian L. McCarty
Green Dolphin Sound Consulting
1726 La Loma Road
Pasadena, CA 91105

Vince Kerouac
Montana State Director
The Good Sam Club
P.O. Box 125
Dayton, MT 59914

Bryan Kim
President
New World Sky Media
553 South Street, #312
Glendale, CA 91202

K. Michael O'Connell, Esq.
Collier, Shannon, Rill & Scott
3050 K Street, N.W.
Washington, D.C. 20007
Counsel to Owner-Operator Independent Drivers Assn., Inc.

M. Scott Johnson, Esq.
Gardner, Carton & Douglas
1301 K Street, N.W.
Suite 900
Washington, D.C. 20005
Counsel to Alabama Broadcasters

Millard J. Watkins, III
General Manager
WHUR
529 Bryant Street, N.W.
Washington, D.C. 20059

Sue Bray
Executive Director/Vice President
The Good Sam Club
P.O. Box 500
Agoura, CA 91376

James W. Gilbert
President & CEO
On Call Communications, Inc.
16800 Aston Street
Irvine, CA 92714

David W. Harris
Code IO
NASA
Washington, D.C. 20546

* By Hand

Kathryn M. Stasko

Kathryn M. Stasko

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ORIGINAL

CD RADIO

March 22, 1996

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MAR 22 1996

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

William F. Caton, Acting Secretary
Federal Communications Commission
1919 M Street, NW
Washington, D.C. 20554

Re: Gen Docket Nos 95-91, 90-357

DOCKET FILE COPY ORIGINAL

Dear Mr. Caton:

Satellite CD Radio, Inc. hereby updates the Commission on the relationship between bandwidth and channel capacity for satellite DARS. CD Radio's most recent rulemaking comments contained an extensive discussion of the requirements for transmitting multiple high-quality audio channels in a given license bandwidth. Comments of CD Radio, Appendix B, at 9-13 (filed September 15, 1995). As indicated in CD Radio's Comments, a variety of multiplexing techniques may in theory be used: time division multiplexing (TDM), code division multiplexing (CDM), and frequency division multiplexing (FDM). The choice of multiplexing technique involves complex engineering choices related to available radio frequency spectrum, satellite radiated power, signal quality requirements, number of channels to be transmitted, and other factors.

CD Radio's efforts to share available spectrum with other applicants have led CD Radio to agree to operate within a single 12.5 MHZ band. Under these circumstances, it is not possible to achieve acceptable signal quality and reliability at satellite power flux densities believed coordinatable with Canada using TDM or FDM. (CD Radio originally contemplated using TDM with the expectation of significantly greater bandwidth being made available .) Therefore, CD Radio now plans to use CDM in its operational satellites, and has designed its system accordingly. If the Commission authorizes a 12.5 MHZ band for CD Radio, we would expect to submit a minor amendment to our system application reflecting the use of CDM to comply with the Commission's bandwidth requirements and to maintain our desired service parameters.

Having chosen code division multiplexing in order to share S-band with other users, CD Radio notes that the selection of license bandwidth becomes all the more critical. A license bandwidth of 12.5 MHZ, with which all current applicants have concurred, permits derivation of 33 high quality channels using CDM -- and an economically viable service must be able to offer at least this number of channels. Reduction of that bandwidth, however, would have severe consequences in terms of channel capacity and economics. Each music channel on both satellites is uniquely coded so that they do not interfere with each other, even though they occupy the same radio frequency spectrum at the same time. This is accomplished by coding each channel so it is orthogonal to the others using special codes (e.g., balanced Gold codes). As radio frequency

bandwidth is reduced, for the same channel data rate, the number of possible balanced Gold codes drops by factors of approximately two. For radio frequency bandwidth less than 10 MHZ, the capacity of the band is reduced to 17 channels, compared to 33 channels at 12.5 MHZ.

Sincerely,

Robert D. Briskman
President

ORIGINAL

CD RADIO

EX PARTE OR LATE FILED

March 29, 1996

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RECEIVED

MAR 29 1996

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, NW, Room 222
Washington, D.C. 20554

Re: Ex parte filing,
IB Dkt. No. 95-91/GEN Docket No. 90-357

Dear Mr. Caton:

On March 28, 1996, the undersigned had a conversation with Ronald T. Repasi of the International Bureau. The conversation concerned CD Radio's change to code division multiplexing (CDM) from time division multiplexing (TDM), in response to its agreement to use no more than 12.5 MHZ bandwidth[1]. The following summarizes the discussion.

The change to CDM required CD Radio to alter certain parameters of its system design. One design element necessarily remained constant: the use of spatial diversity (*i.e.*, transmission of identical signals from two widely separated satellites). Spatial diversity enables CD Radio to provide, in a mobile environment, the high-quality audio signals that the listening public expects.

The change to CDM provides a measure of increased resilience to fading and noise compared to TDM. As a result, the forward error correction for the current system design is rate ½ coding. In a 12.5 MHZ bandwidth, relying on a spatially diverse architecture, using CDM, and operating at satellite radiated power flux density levels that make feasible coordination with Canada, CD Radio's system provides 33 CD-quality audio channels.[2]

If CD Radio abandoned spatial diversity and operated a single satellite system, it would be possible to transmit 66 channels. However, their transmission would have dramatically reduced quality, with little ability to overcome fading and blockage. In our view, such a system would be commercially unacceptable to most consumers. Additionally, to overcome multipath, satellite power would have to be increased by 10 times or more. This approach would itself have two drawbacks. First, a ten-fold increase in power would increase satellite radiated power flux

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[1] *See* Joint Comments of the DARS Applicants (September 15, 1995).

[2] Comments of CD Radio, Appendix B (September 15, 1995).

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1001 22nd Street NW Washington DC 20037 Tel 202.296.6192 Fax 202.296.6265

density levels at the U.S. border by 10 dB or more, making coordination with adjacent countries, especially Canada, correspondingly much more difficult. Second, a 10 fold increase in power is prohibitively expensive and may be beyond current satellite design state of the art.

Sincerely,

Robert D. Briskman
President

cc: Ronald T. Repasi

ORIGINAL

Before the
FEDERAL COMMUNICATION COMMISSION
Washington, D.C. 20554

In the Matter of:	IB Docket No. 95-91 GEN Docket No. 90-357 RM No. 8610
Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHZ Frequency Band	

Comments of CD Radio

CD Radio Inc.

Peter K. Pitsch
Pitsch Communications
2300 N Street, N.W., Suite 600
Washington, D.C. 20037
(202) 663-9039

Of Counsel

Richard E. Wiley
Michael Yourshaw
Carl R. Frank
Michael K. Baker
of
WILEY, REIN & FIELDING
1776 K Street, N.W.
Washington, D.C. 20006
(202) 429-7000

Its Attorneys

Dated: September 15, 1995

E. The Commission's Rules Should Facilitate the Use of Terrestrial Gap Fillers to Optimize Satellite DARS Coverage

Even though CD Radio will employ satellite and frequency diversity to improve its coverage, some terrestrial gap fillers will still be necessary to maximize coverage. Thus, the rules governing terrestrial gap fillers should be sufficiently liberal to easily allow satellite DARS licensees to optimize their coverage. CD Radio favors rules that permit flexible use of terrestrial gap fillers to retransmit signals received from operating satellite DARS systems on the same frequency and using the same bandwidth as the satellite transmitters. By adopting such rules, the Commission will ensure satellite DARS service in areas poorly served (*e.g.*, urban canyons) by satellite signals.

For similar reasons, gap fillers should be permitted on the same frequencies as satellite transmitters. These frequencies have been allocated to DARS and "complementary

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[218] *NPRM*, ¶ 54.

[219] Similarly, the FCC should leave it to the marketplace to regulate the maximum number of channels that can be provided by each licensee.

terrestrial" repeaters[220] and are therefore readily available.[221] Receivers designed to tune a different terrestrial frequency would be costly and might thwart the widespread deployment of satellite DARS receivers, as well as being spectrally inefficient.

In addition, the Commission should permit satellite DARS licensees to construct gap fillers without prior approval or even notification -- an approach similar to that used for the construction of interior cell sites in Part 22 of the Commission's rules.[222] Cellular licensees governed by Part 22 need not notify the FCC of the construction of cell sites that do not affect the "outer cloud" of the licensee's cellular geographic service area.[223] Likewise, gap fillers within a satellite DARS provider's coverage area should be permitted without prior FCC notification.[224]

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[220] *See Allocation Order*, 10 F.C.C. Rcd at 2318.

[221] The *NPRM*'s proposed Section 25.144(a)(2) includes, without elaboration in the text, "radio astronomy service" within the allocated bandwidth for satellite DARS. CD Radio questions the necessity of this language. *See* Appendix E hereto (red-lined version of *NPRM*'s proposed rules).

[222] *See* 47 C.F.R. § 22.165 ("additional transmitters for existing systems") (providing that a cellular licensee may operate additional transmitters at additional locations on the same channel block as its existing system without obtaining prior Commission approval).

[223] *See id.* § 163(e) (notification required for modifications affecting cellular geographic service area boundary).

[224] As with cellular, *see id.* at § 22.163, exceptions to this rule may have to be made for gap-filler repeaters located near adjacent country co-frequency systems. *Cf. id.* at § 1.955 (1994) (coordination with Canada for land mobile stations above 30 MHz); 47 C.F.R. § 73.207(b)(2-3) (1994) (coordination with Canada and Mexico for FM broadcast stations). CD Radio thus proposes that terrestrial gap fillers located within 68 kilometers of the Canadian or Mexican border require prior coordination with adjacent country co-frequency systems. Appendix E hereto includes the proposed text of the relevant rules (*see* proposed 47 C.F.R. § 25.221).

Finally, CD Radio firmly supports the FCC's proposal to limit terrestrial operation of gap fillers only to repeat signals received from an operating satellite DARS service.[225] This ensures that licensees build a satellite rather than an S-band terrestrial DARS System.

ORIGINAL

Before the
FEDERAL COMMUNICATION COMMISSION
Washington, D.C. 20554

In the Matter of:	
Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band	IB Docket No. 95-91 GEN Docket No. 90-357 RM No. 8610

Reply Comments of CD Radio

CD Radio Inc.

Peter K. Pitsch
Pitsch Communications
2300 N Street, N.W., Suite 600
Washington, D.C. 20037
(202) 663-9039

Of Counsel

Richard E. Wiley
Michael Yourshaw
Carl R. Frank
Edward A. Yorkgitis, Jr.
Michael K. Baker
of
WILEY, REIN & FIELDING
1776 K Street, N.W.
Washington, D.C. 20006
(202) 429-7000

Its Attorneys

Dated: October 13, 1995

VI. THE RECORD SUPPORTS FCC ADOPTION OF TECHNICAL RULES THAT ALLOW SATELLITE DARS LICENSEES MAXIMUM FLEXIBILITY TO BETTER SERVE THE PUBLIC

Commenters who addressed technical issues raised in the *NPRM* supported CD Radio's call for rules that are designed to permit satellite DARS licensees maximum flexibility in structuring their service offerings in order to be responsive to marketplace demands.[145] As CD Radio commented, technical rules should reflect the fact that satellite DARS is a new service which must overcome technical and marketing issues that, while no longer barriers to the efficient provision of service, nonetheless counsel against rigid or heavy-handed regulation that might stultify it. Commenters broadly agree with this approach. Nonetheless, a few issues merit brief discussion.[146]

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[145] AMRC at 20; DSBC at 47; Primosphere at 36.

[146] In addition, the Commission should confirm that consumers may rely on the authorization of a satellite DARS provider and need not obtain any additional license or registration for the receive-only mobile earth stations used to obtain the service. Notably, the receive-only dishes used by consumers to receive DBS are not subject to a licensing requirement nor, for that matter, are other types of receive-only satellite earth stations used for domestic service. *See* 47 C.F.R. § 25.131(b) (imposing no licensing or registration requirement for receive-only earth stations, but permitting registration for protection from terrestrial microwave stations in shared bands). Indeed, the Commission consistently and for good reason has declined to impose any subscriber license obligation on equipment used to receive subscription services, even where the equipment units also transmit. *See, e.g., id.*, § 22.927 (mobile stations receiving service from cellular system are considered to be operating under the authorization of the system); *id.*, § 22.571 (mobile stations in two-way paging service operate under authorization of serving system); *id.*, § 25.141 (user

First, while one commenter questioned the applicants' proposed link margins, it is clear that debate on the evidence submitted in support of this proposition is neither required nor appropriate in this proceeding. As documented in its prior technical submissions, CD Radio's link margin is more than adequate to deliver CD-quality service to consumers. Although reasonable minds can differ as to the optimal link margin, CD Radio -- like all other satellite DARS providers -- has a compelling incentive to ensure an adequate margin given that its planned nearly half a billion dollar investment would be imperiled if it failed to deliver subscribers high-quality audio.[147] In any event, link margins can and will be strengthened as necessary through the use of terrestrial gap fillers, as discussed below.[148] Hence, any concern over link margins should be directed toward ensuring that the FCC adopts rules that allow licensees to improve their systems, on a flexible basis, with gap fillers.[149]

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transceivers in radiodetermination satellite service need not be licensed, but are subject to service vendor's blanket license); *id.*, § 95.811(c) (each IVDS subscriber's in-home "response transmitter unit" is authorized under the IVDS system license serving the subscriber).

[147] *See* DSBC at 47.

[148] *See id.* at 48-49.

[149] In a related vein, one commenter raises the concern that cross-polarization may not provide adequate isolation for re-use during mobile conditions. As with link margins, neither CD Radio nor any other prospective provider has any incentive to operate in a way that would degrade, rather than enhance, service to the public. CD Radio continues to test cross-polarization and, of course, will not use this reuse technique if it proves unworkable.

Second, a scant few commenters express support for federal standardization of satellite DARS receivers.[150] These commenters argue that a standardized receiver will promote consumer acceptance of the new service and facilitate its viability. As indicated in its opening comments, CD Radio favors common receivers among DARS licensees that have implemented systems. All of the satellite DARS applicants jointly have agreed to cooperate in this effort.[151] But standards for inter-operability and receiver tunability should be left in the capable hands of affected licensees and manufacturers. The FCC did not mandate compatibility among video DBS providers and, similarly, has never mandated government-imposed receiver standardization in other services such as PCS and LEOs. Since all providers have ample incentives to standardize, the FCC should leave this process to the marketplace. By the same token, formation of an FCC industry advisory committee is not appropriate at this time; the marketplace participants have already begun the work to derive common standards and will continue to do so of their own accord.

Third, the concern expressed by NAB and WFAN-AM that the use of terrestrial gap fillers would "transform the satellite DARS service into a terrestrial-based one" is baseless.[152] In their Joint Comments, the satellite DARS applicants made it abundantly clear that they favor use of gap fillers only: (1) as a means to retransmit the signals of

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[150] *See, e.g.*, Comments of CEG/EIA at 7-9 (advocating an industry-developed minimum standard for both satellite and terrestrial DARS transmission to ensure that consumers can purchase full functioning DARS equipment at reasonable prices).

[151] Joint Comments at 3-4.

[152] NAB at 61; Comments of WFAN-AM at 1.

operating satellite DARS systems on the same frequency; and (2) as a way to improve the service link margin in difficult propagation environments.[153] Hence, this is a non-issue that should not distract the Commission from the more important requirement, referenced above, that satellite DARS licensees be allowed to operate terrestrial gap fillers without prior FCC approval or even notification under most circumstances.[154] By reducing the administrative burden of making satellite DARS systems more robust, the FCC will further the public interest in ensuring that all Americans have access to this new aural service.